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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/698,895
Filing Date: October 31, 2003
Appellant(s): DAMERA-VENKATA, NIRANJAN

Damera-Venkata
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 11/11/2009 appealing from the Office action mailed 7/30/2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

This appeal involves claims 1, 2, 5-7, 9, 12-16, 19-25.

Claims 3, 4, 8, 10, 11, 17, 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is incorrect.

The correct statement is:

The amendments filed on April 7, 2009, have been entered and acted upon by the Examiner.

No amendments were filed after the Non-Final Rejection action dated July 30, 2009.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

Claims 3, 4, 8, 10, 11, 17, 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 4 is object because it depends on claim 3.

Claim 11 is object because it depends on claim 10.

Claim 18 is object because it depends on claim 17.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Akhil Kumar and Anamitra Makur, "On the Phase Response of the Error Diffusion Filter for Image Halftoning" IEEE TRANSACTIONS ON IMAGE PROCESSING, VOL. 8, NO. 9 (SEPTEMBER 1999), pp 1282-1292

6,999,201	Shimizu	2-2006

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 6-7, 9, 13-14, 21, 23 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Kumar et al. (Kumar) (On the Phase Response of the Error Diffusion Filter for Image Halftoning, September 1999).

Regarding claim 1, Kumar discloses an error diffusion halftoning method (e.g., error diffusion method, figure 1) comprising operating a processor (e.g., display devices/printers (processor), Introduction, page 1282) to perform operations comprising: modifying a current input to produce a modified input (e.g., converting a gray tone f(i, j) to y(i, j) (modified input), figure 1, paragraph I), wherein the modifying comprises incorporating past quantization errors into the current input (e.g., past errors d(i, j) into f(i, j) to have modified input y(i, j), figure 1, paragraph I); quantizing the modified input to produce an output (e.g., converting y(i, j) (modified input) to a binary value g(i, j) for output, figure 1, paragraph I); and processing the output through a data processing path having a bandpass transfer characteristic (e.g., error filter h4 **which result in 1- H(wx, wy)** having prominent bandpass shape at horizontal and vertical frequencies, page 1287. Note: Examiner has typo error for missing **"which result in 1- H(wx, wy)"** on

page 1287 on the right column under figure 8 as cited in claim 1 of the Office Action on July 30, 2009; error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph), wherein the processing comprises deriving an error value (e.g., error value e(i, j), figure 1) from the modified input (e.g., modified input y(i, j), figure 1) and the output and diffusing the error value into future inputs (e.g., diffusing the error value d(i, j) into future inputs f(i, j), figure 1).

Regarding claim 2, Kumar discloses wherein the processing comprises shaping quanfization noise in the output in accordance with the bandpass transfer characteristic (e.g., the resulting halftoning noise does get shaped in a desirable way; the halftoning noise spectrum is shaped by 1-H(w(x), w(y)), Proposed Algorithm and Halftoning Noise in Error Diffusion, page 1283).

Regarding claim 6, Kumar disclose wherein the processing comprises bandpass filtering the error value into future inputs (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph).

Referring to claim 7:

Claim 7 is the apparatus claim corresponding to method step in claim 1 with functional steps corresponding directly to the method step elements in claim 1. Therefore claim 7 is rejected as set forth above for claim 1.

Referring to claim 9:

Claim 9 is the apparatus claim corresponding to method step in claim 1 with functional steps corresponding directly to the method step elements in claim 1. Therefore claim 9 is rejected as set forth above for claim 1.

Referring to claim 13:

Claim 13 is the apparatus claim corresponding to method step in claim 6 with functional steps corresponding directly to the method step elements in claim 6. Therefore claim 13 is rejected as set forth above for claim 6.

Referring to claim 14:

Claim 14 is the apparatus claim corresponding to method step in claim 2 with functional steps corresponding directly to the method step elements in claim 2. Therefore claim 14 is rejected as set forth above for claim 2.

Regarding claim 21, Kumar discloses a printer comprising: a print engine; and a processor (e.g., printer/display (inherently having print engine and processor), page 1282) for performing error diffusion halftoning (e.g., error diffusion method, figure 1), the halftoning including performing quantization (e.g., quantizer, figure 1), and using an error signal filtered with an effective bandpass characteristic to influence the quantization without using a result of the quantization to directly influence an input of the quantization characteristic (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph), an output of the quantization supplied to the print engine (e.g., binary output g(i, j) supplied to the print engine, figure 1).

Regarding claim 23, Kumar discloses wherein the modifying comprises incorporating into the current input (e.g., x(n1, n2), figure 2) the past quantization errors filtered in accordance with a bandpass filter transfer function (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph) to produce the modified input (e.g., past errors d(i, j) into f(i, j) to have modified input y(i, j), figure 1, paragraph I), and subtracting the modified input (e.g., modified input y(i, j), figure 1) from the output (e.g., output g(i, j), figure 1) to produce the error value (e.g., error e(i, j), figure 1).

Regarding claim 25, Kumar discloses wherein the processor (e.g., printer/display (inherently have processor), page 1282) is operable to perform operations comprising: modifying a current input (e.g., current input f(i, j), figure 1) to produce a modified input (e.g., modified input y(i, j), figure 1), wherein the modifying comprises incorporating past quantization errors into the current input (e.g., quantization errors d(i, j), figure 1); quantizing the modified input to produce an output (e.g., output g(i, j), figure 1); and processing the output through a data processing path having a bandpass transfer characteristic (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph), wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs (e.g., diffusing the error value d(i, j) into future inputs f(i, j), figure 1).

Claims 5, 12, 15-16, 19-20, 22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumar et al. (Kumar) (On the Phase Response of the Error Diffusion Filter for Image Halftoning, September 1999) as applied to claim 1 above, and further in view of Shimizu (US 6,999,201).

Regarding claim 5, Kumar does not explicitly disclose generating second error value based on the filtered output and the modified input and low pass filtering the second error value with a second linear weighting filter to produce the first error value.

Shimizu disclose generating second error value (e.g., w(n1,n2), figure 2) based on the filtered output (e.g., g(n1,n2), figure 2) and the modified input (e.g., modified input at 215, figure 2) and low pass filtering the second error value with a second linear weighting filter (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter) to produce the first error value (e.g., e(n1, n2) at 285, figure 2).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include generating second error value based on the filtered output and the modified input and low pass filtering the second error value with a second linear weighting filter to produce the first error value as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

<u>Referring to claim 12</u>:

Claim 12 is the apparatus claim corresponding to method step in claim 5 with functional steps corresponding directly to the method step elements in claim 5. Therefore claim 12 is rejected as set forth above for claim 5.

Regarding claim 15, Kumar discloses a processor (e.g., printer/display (inherently having processor), page 1282) to perform error diffusion halftoning (e.g., error diffusion method, figure 1), the error diffusion halftoning including performing quantization (e.g., quantizer, figure 1), and filtering (e.g., error filter, figure 1) with an effective bandpass characteristic without using an output of the quantization to directly influence an input of the quantization (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph).

Kumar does not explicitly disclose a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the processor to perform error diffusion halftoning.

Shimizu disclose a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the processor to perform error diffusion halftoning (e.g., the processing for this invention can be carried out by a computer program. This computer program can be executed by a computer system shown in FIG. 12).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the

processor to perform error diffusion halftoning as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to conveniently process error diffusion halftoning from software program.

Regarding claim 16, Kumar discloses wherein the filtered error signal is used to modify the quantization input (e.g., Error filter used to modify y(i, j), figure 1).

Regarding claim 19, Kumar differs from claim 19 in that he does not explicitly disclose and low pass filtering the error signal with a second linear weighting filter.

Shimizu discloses low pass filtering the error signal with a second linear weighting filter (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include low pass filtering the error signal with a second linear weighting filter as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

Regarding claim 20, Kumar discloses generating an error from the quantization input and output (e.g., error e(i, j) generating from y(i, j) and g(i, j), figure 1); and applying an infinite impulse response filter to the error signal (e.g., error filter to error

signal e(i, j), figure 1, an output of the infinite impulse response filter used to modify the quantization input (e.g., output from error filter d(i, j) to y(i, j), figure 1).

Regarding claim 22, Kumar differs from claim 22 in that he does not disclose subtracting the modified input from the modified output to produce a second error value filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value; and the modifying comprises incorporating into the current input past error values filtered in accordance with the second low-pass filter transfer function to produce the modified input.

Shimizu discloses subtracting the modified input (e.g., modified input at 215, figure 2) from the modified output (e.g., g(n1, n2) or value at 245, figure 2) to produce a second error value (e.g., w(n1,n2), figure 2) filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter) to produce the first error value (e.g., e(n1, n2) at 285, figure 2); and the modifying comprises incorporating into the current input (e.g., current input x(n1, n2), figure 2) past error values filtered (e.g., e(n1, n2) at 285, figure 2) in accordance with the second low-pass filter transfer function to produce the modified input (e.g., modified input at 215, figure 2).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include subtracting the modified input from

the modified output to produce a second error value filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value; and the modifying comprises incorporating into the current input past error values filtered in accordance with the second low-pass filter transfer function to produce the modified input as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

Regarding claim 24, Kumar differs from claim 24 in that he does not disclose the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations.

Shimizu discloses the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations (e.g., The processing for this invention can be carried out by a computer program. This computer program can be executed by a computer system shown in FIG. 12).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to conveniently process error diffusion halftoning from software program.

(10) Response to Argument

Regarding claim 1:

Appellant, on pages 5 of the appeal brief, argues that Kumar does not disclose "processing the output through a data processing path having a bandpass transfer characteristic."

In response: Kumar discloses processing the output through a data processing path having a bandpass transfer characteristic (e.g., (e.g., error filter h4 **which result in 1- H(wx, wy)** having prominent bandpass shape at horizontal and vertical frequencies, page 1287. Note: Examiner has typo error for missing **"which result in 1- H(wx, wy)"** on page 1287 on the right column under figure 8, as cited in claim 1 of the Office Action on July 30, 2009).

Regarding claims 2, 6, and 23:

Appellant, on page 7 of the appeal brief, argues that each of claims 2, 6, and 23 incorporates the elements of independent claim 1 and
therefore is patentable over Kumar for at least the same reasons explained above in connection with independent claim 1.

In response:

Regarding claim 2, Kumar discloses wherein the processing comprises shaping quanfization noise in the output in accordance with the bandpass transfer characteristic (e.g., the resulting halftoning noise does get shaped in a desirable way; the halftoning noise spectrum is shaped by 1-H(w(x), w(y)), Proposed Algorithm and Halftoning Noise in Error Diffusion, page 1283).

Regarding claim 6, Kumar disclose wherein the processing comprises bandpass filtering the error value into future inputs (e.g., error filter h(k, l) (transfer function) with

preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph).

Regarding claim 23, Kumar discloses wherein the modifying comprises incorporating into the current input (e.g., x(n1, n2), figure 2) the past quantization errors filtered in accordance with a bandpass filter transfer function (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph) to produce the modified input (e.g., past errors d(i, j) into f(i, j) to have modified input y(i, j), figure 1, paragraph I), and subtracting the modified input (e.g., modified input y(i, j), figure 1) from the output (e.g., output g(i, j), figure 1) to produce the error value (e.g., error e(i, j), figure 1).

Regarding claims 7:

Appellant, on page 7 of the appeal brief, argues that independent claim 7 recites elements that essentially track the pertinent elements of independent claim 1 discussed above. In particular, claim 7 recites the “modifying”, the “quantizing”, and “ processing” elements of independent claim 1 and, therefore, is patentable over Kumar for at least the same reason explained above in connection with independent claim 1.

In response:

Claim 7 is the apparatus claim corresponding to method step in claim 1 with functional steps corresponding directly to the method step elements in claim 1. Therefore claim 7 is rejected as set forth above for claim 1.

Regarding claims 9, 13 and 14:

Appellant, on page 7 of the appeal brief, argues that independent claim 9 recites elements that essentially track the pertinent elements of
independent claim I discussed above. In particular, claim 9 recites the “modifying”, the "quantizing”, and “processing" elements of independent claim 1 and, therefore, is patentable over Kumar for at least the same reasons explained above in connection with independent claim 1.

In response:

Referring to claim 9:

Claim 9 is the apparatus claim corresponding to method step in claim 1 with functional steps corresponding directly to the method step elements in claim 1. Therefore claim 9 is rejected as set forth above for claim 1.

Referring to claim 13:

Claim 13 is the apparatus claim corresponding to method step in claim 6 with functional steps corresponding directly to the method step elements in claim 6. Therefore claim 13 is rejected as set forth above for claim 6.

Referring to claim 14:

Claim 14 is the apparatus claim corresponding to method step in claim 2 with functional steps corresponding directly to the method step elements in claim 2. Therefore claim 14 is rejected as set forth above for claim 2.

Regarding claims 21 and 25:

Appellant, on pages 7 and 8 of the appeal brief, argues that independent claim 21 recites elements that essentially track the pertinent elements of independent claim 1 discussed above. In particular, claim 21 recites in part “a processor for performing error diffusion halftoning, the halftoning including performing quantization, and using an error signal filtered with an effective bandpass characteristic to influence the quantization without using a result of the quantization to directly influence an input of the quantization," For the stone reasons explained above in connection with independent claim 1, Kumar does not expressly nor inherently disclose "using an error signal filtered with an effective bandpass characteristic to influence the quantization without using a result of the quantization to directly influence an input of the quantization," as recited in claim 21. Therefore, independent at claim 21. is patentable over Kumar for at least the same reasons explained above in connection with independent claim 1. Claim 25 incorporates the elements of independent clam 21 and therefore is patentable over Kumar for at least the same reasons explained above in connection with independent claim 21 (via claim I). In particular; claim 25 recites the “modifying", the “quantizing", and “processing" elements of independent claim I and. therefore, is patentable over Kumar for at least the stone reasons explained above in connection, with independent claim 1.

In response:

Referring to claim 21:

Regarding claim 21, Kumar discloses a printer comprising: a print engine; and a processor (e.g., printer/display (inherently having print engine and processor), page

1282) for performing error diffusion halftoning (e.g., error diffusion method, figure 1), the halftoning including performing quantization (e.g., quantizer, figure 1), and using an error signal filtered with an effective bandpass characteristic to influence the quantization without using a result of the quantization to directly influence an input of the quantization characteristic (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph), an output of the quantization supplied to the print engine (e.g., binary output g(i, j) supplied to the print engine, figure 1).

Referring to claim 25:

Regarding claim 25, Kumar discloses wherein the processor (e.g., printer/display (inherently have processor), page 1282) is operable to perform operations comprising: modifying a current input (e.g., current input f(i, j), figure 1) to produce a modified input (e.g., modified input y(i, j), figure 1), wherein the modifying comprises incorporating past quantization errors into the current input (e.g., quantization errors d(i, j), figure 1); quantizing the modified input to produce an output (e.g., output g(i, j), figure 1); and processing the output through a data processing path having a bandpass transfer characteristic (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph), wherein the processing comprises deriving an error value from the modified input and the output and diffusing the error value into future inputs (e.g., diffusing the error value d(i, j) into future inputs f(i, j), figure 1).

Regarding claims 5 and 22:

Appellant, on pages 12-14 of the appeal brief, argues that each of claims 5 and 22 incorporates the elements of independent clam 1, Shimizu does not make-up for the failure of Kumar to disclose or suggest the pertinent elements of independent claim 1 discussed above. Therefore, Claims 5 and 22 are patentable over Kumar in view of Shimizu for at least the same reasons explained above in connection with independent claim 1.

In response:

Regarding claim 5, Kumar differs from claim 5 in that he does not explicitly disclose generating second error value based on the filtered output and the modified input and low pass filtering the second error value with a second linear weighting filter to produce the first error value.

Shimizu disclose generating second error value (e.g., w(n1,n2), figure 2) based on the filtered output (e.g., g(n1,n2), figure 2) and the modified input (e.g., modified input at 215, figure 2) and low pass filtering the second error value with a second linear weighting filter (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter) to produce the first error value (e.g., e(n1, n2) at 285, figure 2).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include generating second error value based on the filtered output and the modified input and low pass filtering the second error value with a second linear weighting filter to produce the first error value as taught by

Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

Regarding claim 22, Kumar differs from claim 22 in that he does not disclose subtracting the modified input from the modified output to produce a second error value filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value; and
the modifying comprises incorporating into the current input past error values filtered in accordance with the second low-pass filter transfer function to produce the modified input.

Shimizu discloses subtracting the modified input (e.g., modified input at 215, figure 2) from the modified output (e.g., g(n1, n2) or value at 245, figure 2) to produce a second error value (e.g., w(n1,n2), figure 2) filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter) to produce the first error value (e.g., e(n1, n2) at 285, figure 2); and the modifying comprises incorporating into the current input (e.g., current input x(n1, n2), figure 2) past error values filtered (e.g., e(n1, n2) at 285, figure 2) in accordance with the second low-pass filter transfer function to produce the modified input (e.g., modified input at 215, figure 2).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include subtracting the modified input from the modified output to produce a second error value filtering the second error value in accordance with a second low-pass filter transfer function to produce the first error value; and the modifying comprises incorporating into the current input past error values filtered in accordance with the second low-pass filter transfer function to produce the modified input as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

<u>Regarding claims 12:</u>

Appellant, on page 14 of the appeal brief, argues that claim 12 incorporates the elements of independent claim 9. Shimizu does not makeup for the failure of Kumar to disclose or suggest the pertinent elements of independent claim 9.

In response:

Claim 12 is the apparatus claim corresponding to method step in claim 5 with functional steps corresponding directly to the method step elements in claim 5. Therefore claim 12 is rejected as set forth above for claim 5.

<u>Regarding claims 15, 16, 19, 20 and 24:</u>

Regarding claim 15, Appellant, on page 14 of the appeal brief, argues that Kumar does not expressly nor inherent disclose “filtering with an effective bandpass characteristic without using an output of the quantization to directly influence ab input of

the quantization," as recited in claim 15. Shimizu does not make up for the failure of Kumar to disclose or suggest this element of independent claim 15.

Regarding claim 16, 19, 20 and 24, Appellant, on page 14 of the appeal brief, argues that each of claims 16, 19, 20 and 24 incorporates the elements of independent 15 and therefore is patentable over Kumar in view of Shimizu for at least the same reasons explained above in connection with independent claim 15 (via claim 1).

In response:

Regarding claim 15, Kumar discloses a processor (e.g., printer/display (inherently having processor), page 1282) to perform error diffusion halftoning (e.g., error diffusion method, figure 1), the error diffusion halftoning including performing quantization (e.g., quantizer, figure 1), and filtering (e.g., error filter, figure 1) with an effective bandpass characteristic without using an output of the quantization to directly influence an input of the quantization (e.g., error filter h(k, l) (transfer function) with preferably with its pass band not less than the passband of the human visual system, figure1, page 1285, third paragraph).

Kumar does not explicitly disclose a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the processor to perform error diffusion halftoning.

Shimizu disclose a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the processor to perform error diffusion halftoning (e.g., the processing for this invention can be carried out by a

computer program. This computer program can be executed by a computer system shown in FIG. 12).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include a machine-readable memory storing processor-readable instructions that, when executed by a processor, causes the processor to perform error diffusion halftoning as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to conveniently process error diffusion halftoning from software program.

Regarding claim 16, Kumar discloses wherein the filtered error signal is used to modify the quantization input (e.g., Error filter used to modify y(i, j), figure 1).

Regarding claim 19, Kumar differs from claim 19 in that he does not explicitly disclose and low pass filtering the error signal with a second linear weighting filter.

Shimizu discloses low pass filtering the error signal with a second linear weighting filter (e.g., weight coefficient lamda block 280 and associated with adaptive algorithm block 270, figure 2. Note: weight coefficient associated with adaptive algorithm to produce the quantization error e(n1, n2). Thus it is considered as second linear weighting filter).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include low pass filtering the error signal with a second linear weighting filter as taught by Shimizu. It would have been obvious to one

of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to obtain more accurate error values for error diffusion processing.

Regarding claim 20, Kumar discloses generating an error from the quantization input and output (e.g., error e(i, j) generating from y(i, j) and g(i, j), figure 1); and applying an infinite impulse response filter to the error signal (e.g., error filter to error signal e(i, j), figure 1, an output of the infinite impulse response filter used to modify the quantization input (e.g., output from error filter d(i, j) to y(i, j), figure 1).

Regarding claim 24, Kumar differs from claim 24 in that he does not disclose the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations.

Shimizu discloses the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations (e.g., The processing for this invention can be carried out by a computer program. This computer program can be executed by a computer system shown in FIG. 12).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar to include the machine readable medium stores processor readable instructions causing the processor to perform error diffusion operations as taught by Shimizu. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified Kumar by the teaching of Shimizu to conveniently process error diffusion halftoning from software program.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Quang N Vo/

Examiner, Art Unit 2625

Conferees:

/David K Moore/

Supervisory Patent Examiner, Art Unit 2625

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